

Why Your Body Clock Gets Out of Whack

Sleep rhythms lose beat when knocked off the 24-hour cycle of day and night



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Is this a familiar look? If so, it could be worthwhile to stick closer to the 24-hour cycle set by the sun. Photo: Getty Images

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11 COMMENTS

Forget that it's the last holiday weekend of summer. For your own good, try to resist the urge to stay up late. Otherwise, when the alarm sounds on Tuesday, your body may revolt.

The phenomenon is known as social jet lag. It happens when weekday and weekend sleep schedules don't match up, and the body's internal clock gets out of sync with the environment.

"When the rhythm is synced up appropriately, our bodies can anticipate what's needed next and how to time it appropriately," says Mary A. Carskadon, a sleep expert at Brown University.

The body's master timekeeper resides in the hypothalamus, a section of the brain that produces hormones to help control different bodily functions. It's set according to exposure to light and darkness, and when it gets out of sync with the 24-hour environmental clock, the body gets confused, affecting the ebb and flow of hormones.

For most people, the clock runs slightly longer than 24 hours, but for about 20% of the population colloquially known as morning people, it is a little shorter.

"If the clock is longer, you naturally tend to want the day to be longer," said Kenneth P. Wright, director of the Sleep and Chronobiology Laboratory at the University of Colorado Boulder^[1]. "Clocks close to or shorter than 24 hours have an internal drive to go to bed earlier and get up earlier."

The amount of sleep the body needs is the same—about 7½ hours for adults and around 9 for tweens and teens—but the clock tells the body when to sleep and wake, and each day, it resets itself according to environmental prompts.

Here's how it works:

Darkness signals the biological clock to increase the flow of melatonin. In nocturnal animals, that is the cue to wake up. In humans and other diurnal creatures, it is the cue to go to sleep.

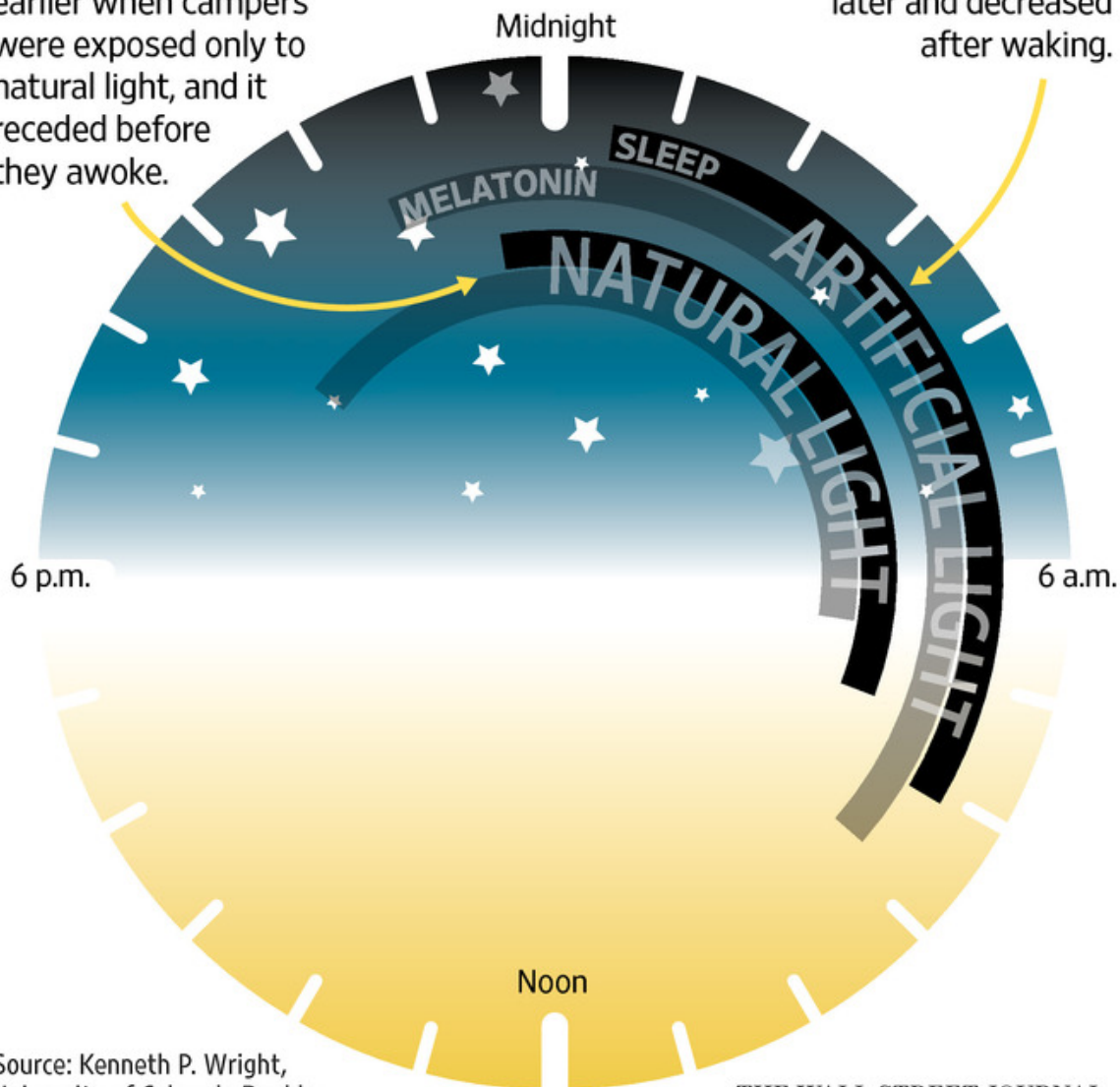
Light, on the other hand, signals the biological clock to reduce the flow of melatonin, indicating the beginning of the new day.

The problem for humans is that exposure to light is now driven by technology more than by nature.

Rhythm of the Night

Melatonin, a hormone that triggers sleep, increased earlier when campers were exposed only to natural light, and it receded before they awoke.

With artificial light, melatonin increased later and decreased after waking.



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Circadian scientists, who study the biological clock, have believed for some time that artificial light leads to later bedtimes, and Dr. Wright tested the theory [2] by taking 8 healthy adults camping.

The participants wore sensors known as actigraphs on their wrists for one week before the camping trip to measure their light exposure, sleep and movements.

“After that, they came into the laboratory so we could under controlled conditions assess the timing of their internal clocks,” Dr. Wright said.

With their baseline measurements recorded, the participants, still wearing actigraphs, went camping for 1 week and were deprived of all artificial light.

“We didn’t even allow flashlights,” Dr. Wright said. “There was sunlight, starlight and campfires.”

Afterward, the participants returned to the lab where their internal clocks were reassessed.

“What was striking is that after camping, our biological night, when melatonin levels rise, nearly synced perfectly with sunset,” Dr. Wright said.

The participants’ melatonin levels rose about 2 hours earlier than in the modern environment and receded about an hour before waking. In the modern environment, melatonin levels didn’t drop to lower daytime levels until an hour or so after waking.

“The clock is still telling us that it is biologically nighttime, and we should still be sleeping,” he said.

Altering the schedule on weekends adds to the confusion, and adolescents may have it worst of all. Their maturing biological clocks naturally push them to remain awake a little later at night, and artificial light adds to the pressure—but they still need about 9 hours of sleep, Dr. Carskadon said.

“School says you need to get up earlier, but the body system says to stay up later,” Dr. Carskadon said. “What gets squeezed out in the middle is how much sleep time there

is.”

There is a perception that the sleep-deprived can “catch up” on the weekend, but research presented at this year’s Sleep Meeting of the Associated Professional Sleep Societies^[3] disputes that concept.

The research, which hasn’t been published, showed that sleep-deprived healthy adults struggle with a simple test of alertness that involves pressing button when a light comes on.

“As soon as you take sleep away, there are more lapses on the test,” said David F. Dinges, a sleep expert at the University of Pennsylvania, who conducted the study.

But the real surprise occurred after the sleep-deprived participants were allowed to catch up on sleep for a brief interval before resuming a sleep-deprived schedule.

“It looked like they bounced right back,” Dr. Dinges said. “Then they recycled back into restricted sleep, and to our utter astonishment, they didn’t start from the recovery point. As soon as we restricted their sleep for one night, it was as if they never recovered.”

The best bet, the researchers say, is to get the recommended amount of sleep and stick to the same schedule on weekdays and weekends.

Or, to put it another way—with apologies to the pop group DeBarge^[4]—to the beat of the rhythm of the night, sleep until the morning light.

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1. [http://www.cell.com/current-biology/abstract/S0960-9822\(13\)00764-1](http://www.cell.com/current-biology/abstract/S0960-9822(13)00764-1)
2. [http://www.cell.com/current-biology/abstract/S0960-9822\(13\)00764-1](http://www.cell.com/current-biology/abstract/S0960-9822(13)00764-1)
3. <http://www.sleepmeeting.org/event/2015/06/06/dates-deadlines/sleep-2015-the-29th-annual-meeting-of-the-associated-professional-sleep-societies>
4. <https://www.youtube.com/watch?v=cAQSZhazYk8>

5. <mailto:Jo.McGinty@wsj.com>