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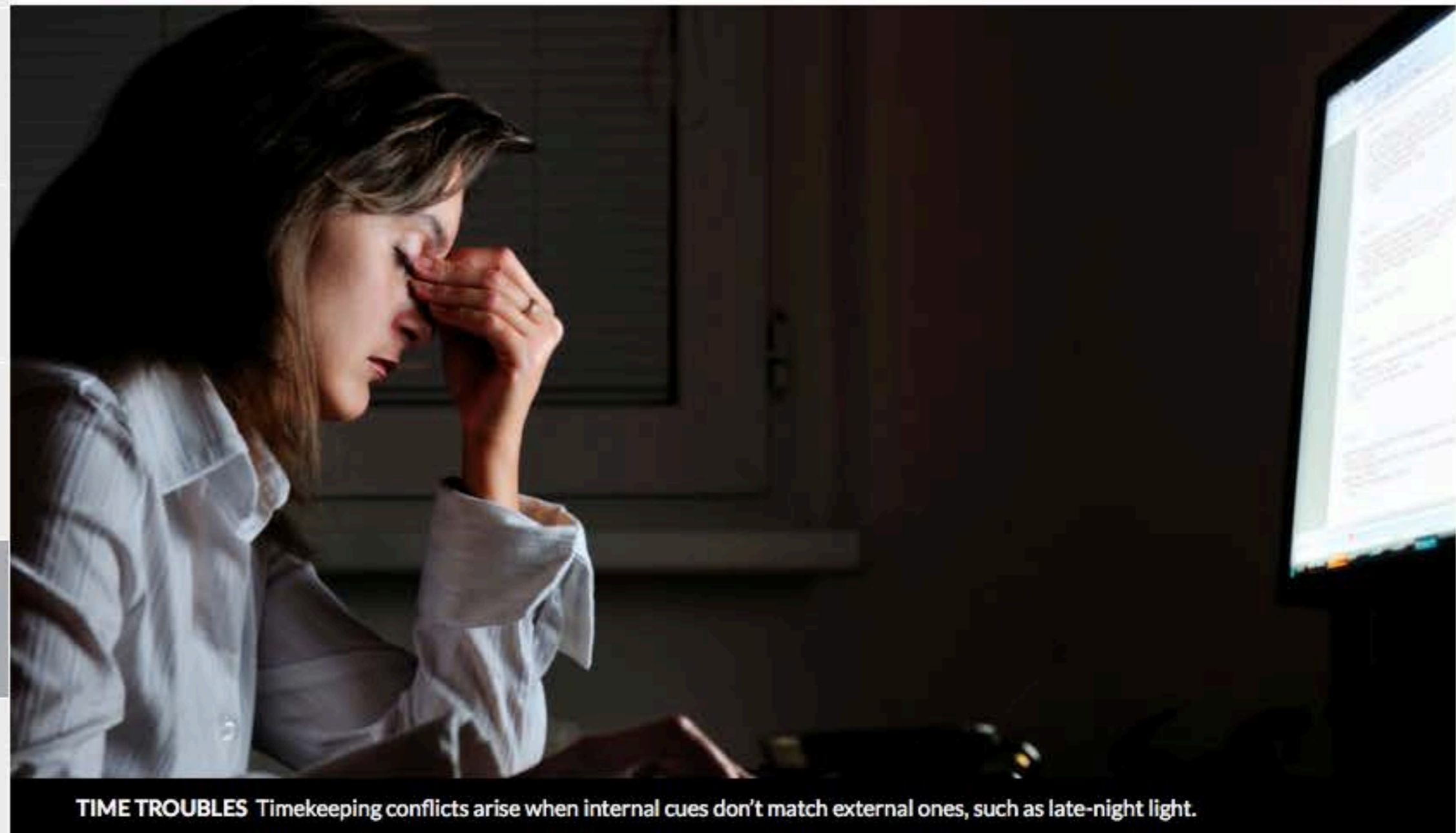
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Out-of-sync body clock causes more woes than sleepiness

Bayesian math describes conflicts leading to maladies labeled 'circadian-time sickness'

BY LAURA SANDERS 7:00AM, OCTOBER 17, 2016



TIME TROUBLES Timekeeping conflicts arise when internal cues don't match external ones, such as late-night light.

MARTINAN/ISTOCKPHOTO

When the body's internal sense of time doesn't match up with outside cues, people can suffer, and not just from a lack of sleep.

Such ailments are similar in a way to motion sickness — the queasiness caused when body sensations of movement don't match the external world. So scientists propose calling time-related troubles, which can afflict time-zone hoppers and people who work at night, "circadian-time sickness." This malady **can be described, these scientists say, with a certain type of math.**

The idea, to be published in *Trends in Neurosciences*, is "intriguing and thought-provoking," says neuroscientist Samer Hattar of Johns Hopkins University. "They really came up with an interesting idea of how to explain the mismatch."

Neuroscientist Raymond van Ee of Radboud University in the Netherlands and colleagues knew that many studies had turned up ill effects from an out-of-whack circadian clock. Depression, metabolic syndromes and memory troubles have been found alongside altered daily rhythms. But despite these results, scientists don't have a good understanding of how body clocks work, van Ee says.

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BY LAURA SANDERS

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Van Ee and colleagues offer a new perspective by using a type of math called Bayesian inference to describe the circadian trouble. Bayesian inference can be used to describe how the brain makes and refines predictions about the world. This **guesswork relies on** the combination of previous knowledge and incoming sensory information (*SN: 5/28/16, p. 18*). In the case of circadian-time sickness, these two cues don't match up, the researchers propose.

Some pacemaking nerve cells respond directly to light, allowing them to track the outside environment. Other pacemakers don't respond to light but rely on internal signals instead. Working together, these two groups of nerve cells, without any supervision from a master clock, can set the body's rhythms. But when the two timekeepers arrive at different conclusions, the conflict muddies the time readout in the body, leading to a confused state that could cause poor health outcomes, van Ee and colleagues argue.

This description of circadian-time sickness is notable for something it leaves out — sleep. While it's true that shifted sleep cycles can cause trouble, a misalignment between internal and external signals may cause problems even when sleep is unaffected, the researchers suggest. That runs counter to the simple and appealing idea that out-of-sync rhythms cause sleep deprivation, which in turn affects the body and brain. That idea "was totally linear and beautiful," Hattar says. "But once you start looking very carefully at the data in the field, you find inconsistencies that people ignored."

It's difficult to disentangle sleep from circadian misalignments, says neuroscientist Ilia Karatsoreos of Washington State University in Pullman. Still, research by him and others has turned up detrimental effects from misaligned circadian rhythms — even when sleep was normal. This new paper helps highlight why "it is important to be able to study and understand the contribution of each," he says.

The concept of circadian-time sickness is an idea that awaits testing, Karatsoreos cautions. Yet it's a "useful way for us to talk about this general problem, if only for the fact that it's a way of thinking that I've really never seen before."

Citations

R. van Ee et al. **Circadian-time sickness: Time-of-day cue-conflicts directly affect health.** *Trends in Neurosciences*. Published online October 5, 2016. doi: 10.1016/j.tins.2016.09.004.

Further Reading

L. Sanders. **Bayesian reasoning implicated in some mental disorders.** *Science News*. Vol. 189, May 28, 2016, p. 18.

